

CLAIM AMENDMENTS

Claims 1 to 7 (cancelled).

1 8. (New) A method of animating a synthesized model of a
2 human face driven by an audio driving signal, comprising an
3 analytic phase, in which
4 an alphabet of low level visemes is determined, and
5 a synthesis phase, in which
6 the audio driving signal is converted into a sequence of
7 low level visemes applied to a model, wherein said analytic phase
8 comprises the steps of
9 extracting both a set of information representing a shape
10 of a speaker's face and corresponding sequences of phonetic units
11 from a set of audio training signals;
12 compressing said set of information into active shape
13 model parameter vectors representative of phonetic units;
14 associating to said active shape model parameter vectors
15 representative of phonetic units an interpolation function to
16 provide a continuous representation of movement between phonemes,

17 wherein said interpolation function is a convex combination having
18 combination coefficients variable as a continuous function of time
19 whereby said association determines said alphabet of low level
20 visemes;

21 associating low level parameters of facial animation,
22 compliant with Standard ISO/IEC 14496 VER. 1, to said low level
23 visemes;

24 wherein said synthesis phase comprises the steps of
25 extracting a sequence of phonetic units of an audio
26 driving signal;

27 associating to said sequence of phonetic units extracted
28 in said synthesis phase a corresponding sequence of low level
29 visemes as determined in the analytic phase;

30 transforming said sequence of low level visemes of said
31 synthesis phase through an interpolation function to provide a
32 continuous representation of movement between phonemes, wherein
33 said interpolation function of said synthesis phase is a convex
34 combination having combination coefficients variable as a
35 continuous function of time; and

wherein the combination coefficients carried out in the synthesis phase are the same as those used in the analytic phase.

9. (New) The method according to claim 8, wherein the combination coefficients $B_n(t)$ of said convex combinations are functions of the following type:


$$\beta_n(t) = \begin{cases} \cos^2\left(\frac{\pi}{2} \frac{t - t_n}{t_{n+1} - t_n}\right); & t \in [t_n, t_{n+1}] \\ \cos^2\left(\frac{\pi}{2} \frac{t - t_n}{t_n - t_{n-1}}\right); & t \in [t_{n-1}, t_n] \\ 0; & t \notin [t_{n-1}, t_{n+1}] \end{cases}$$

where t_n is the instant of utterance of the nth phonetic units.

10. (New) The method according to claim 9 wherein the wire-frame vertices, corresponding to model feature points, on the basis of which facial animation parameters are determined in the analytic phase, are identified and said low-level viseme interpolation operations are conducted by applying transforms on

6 feature points for each low-level viseme, for animating a wire-
7 frame based model.

1 11. (New) The method according to claim 10 wherein for
2 each position to be assumed by the model in said synthesis phase,
3 the transforms are applied only to the vertices of the wire-frame
4 corresponding to the feature points and the transforms are extended
5 to remaining vertices by means of a convex combination of the
6 transforms applied to the vertices of the wire-frame corresponding
7 to the feature points.



1 12. (New) The method according to claim 8 wherein said
2 low-level visemes are converted into co-ordinates of the feature
3 points of the face of the speaker, followed by conversion of said
4 co-ordinates into low-level facial animation parameters compliant
5 with Standard ISO/IEC 14496 VER.1.

1 13. (New) The method according to claim 12 wherein said
2 low-level facial animation parameters, representing the

3 co-ordinates of feature points, are obtained in the analytic phase
4 by analyzing movements of a set of markers which identify the
5 feature points.

1 14. (New) The method according to claim 13 wherein data
2 representing the co-ordinates of the feature points of the face are
3 normalized according to the following method:

4 a sub-set of markers are associated to a stiff object
5 applied to the forehead of the speaker;

6 the face of the speaker is set, at the beginning of the
7 recording, to assume a position corresponding as far as possible to
8 the position of a neutral face model, as defined in standard
9 ISO/IEC 14496, and a first frame of the face in such neutral
10 position is obtained; and

11 for all frames subsequent to the first frame, the sets of
12 co-ordinates are rotated and translated so that the co-ordinates
13 corresponding to the markers of said sub-set coincide with the
14 co-ordinates of the markers of the same sub-set in the first frame.


1 15. (New) A method of generating an alphabet of low
2 level visemes for animating a synthesized model of a human face
3 driven by an audio signal, comprising the steps of

4 extracting both a set of information representing the
5 shape of a speaker's face and corresponding sequences of phonetic
6 units from a set of audio training signals;

7 compressing said set of information into active shape
8 model (ASM) parameter vectors; and

9 associating to said active shape model (ASM) parameter
10 vectors representative of phonetic units an interpolation function
11 to provide a continuous representation of movement between
12 phonemes, wherein said interpolation function is a convex
13 combination having combination coefficients variable as a
14 continuous function of time whereby said association determines
15 said alphabet of low level visemes.

1 16. (New) The method according to claim 15 wherein the
 2 combination coefficients $B_n(t)$ of said convex combinations are
 3 functions of the following type:



$$\beta_n(t) = \begin{cases} \cos^2\left(\frac{\pi}{2} \frac{t-t_n}{t_{n+1}-t_n}\right); & t \in [t_n, t_{n+1}] \\ \cos^2\left(\frac{\pi}{2} \frac{t-t_n}{t_n-t_{n-1}}\right); & t \in [t_{n-1}, t_n] \\ 0; & t \notin [t_{n-1}, t_{n+1}] \end{cases}$$

4 where t_n is the instant of utterance of the nth phonetic units.